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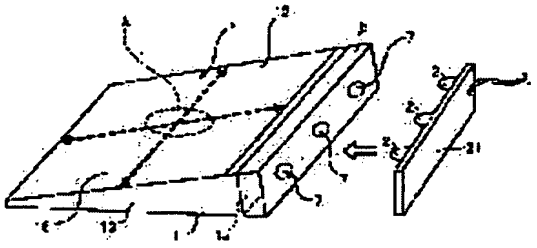
(54) PLANE LIGHT SOURCE DEVICE

(57)Abstract:

PROBLEM TO BE SOLVED: To provide a plane light source device with the number of point light sources such as an LED element reduced and with brightness unevenness eliminated.

SOLUTION: With the plane light source device which lets in light from a plurality of point light sources 2... arranged at one of the side end faces of a light guide plate 1, reflects it with a light reflecting face 11 of the light guide plate 1 and emits it from a light-emitting face 12 of the light guide plate 1, a prism face 16 is formed on the light-emitting face 12 in the direction vertical to the point light sources 2.



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* NOTICES *

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CLAIMS

[Claim(s)]
[Claim 1] Surface light source equipment which carries out incidence of the light from two or more point light sources arranged to one side of the side edge side of a light guide plate, is surface light source equipment which reflects in respect of the light reflex of a light guide plate, and emits light from the optical outgoing radiation side of a light guide plate, and is characterized by forming the vertical prism side in the part of said optical outgoing radiation side which a firefly phenomenon generates at least at said point light source.
[Claim 2] Said prism side is surface light source equipment according to claim 1 characterized by being prepared all over an optical outgoing radiation side.
[Claim 3] Surface light source equipment according to claim 1 or 2 characterized by performing concavo-convex processing to the light reflex side of said light guide plate located in the intermittent section of said point light source.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention consists of the aggregate of the point light source which consists of a light emitting device like a light emitting diode (LED) component, and relates to the surface light source equipment mainly used for the lighting system of a liquid crystal display.
[0002]
[Description of the Prior Art] In recent years, the technique of attaining lightweight-izing of electronic equipment, miniaturization, and low-power-ization is developing remarkably. using the nonluminescent display device represented by the liquid crystal display in the flow of this technique -- electronic equipment -- lightweight-izing -- it is miniaturized and, moreover, has been low-power-ized.
[0003] As a liquid crystal display, there are a transparency mold and a reflective mold, the lighting system which illuminates a liquid crystal display from a background, and the so-called back light are prepared in the liquid crystal display of a transparency mold, and the so-called front light which illuminates a liquid crystal display from a side front is prepared in the liquid crystal display of a reflective mold.
[0004] As surface light source equipment for liquid crystal displays, the thing of the edge light method which made the translucency plate the transparent material is known. With such surface light source equipment, carry out incidence of the light from one side of the side edge side of the light guide plate which consists of a transparent parallel plate or a cross-section wedge plate, i.e., the edge section, light is made to spread uniformly throughout a light guide plate, and the diffused light is emitted from diffuse reflection light, nothing, and a light guide plate front face for a part of the spread light by the light reflex member on the rear face of a light guide plate.
[0005] Since thickness of a light guide plate being made thin and a configuration can be simplified, the light guide plate of an edge light method used as surface light source equipment for liquid crystal displays is used widely.
[0006] A cold cathode tube lamp is used as the light source, and, as for many of surface light source equipments of an edge light method, the cold cathode tube lamp is formed in the edge section of a light guide plate. However, pocket mold equipment spreads in recent years, and the thing using the punctiform light sources, such as the light emitting diode (LED) light source with little power consumption, is put in practical use compared with the cold cathode tube lamp from a viewpoint of low-power-izing etc.
[0007] The surface light source equipment using the conventional LED component is shown in drawing 1 and drawing 2 . The perspective view showing the condition that drawing 1 equipped the light guide plate of conventional surface light source equipment with the reflective sheet, and drawing 2 are the sectional views showing the outline configuration of conventional surface light source equipment.
[0008] As shown in drawing 1 and drawing 2 , this surface light source equipment consists of point light source 2 --, various control circuits (not shown), etc. which consisted of a light guide plate 1 and LED. In this control circuit, the total amount of the light by which outgoing radiation is carried out from the optical outgoing radiation side 12 of a light guide plate 1 is detected, and the circuit which adjusts and supplies power is also included in the point light source 2 in it so that the outgoing

radiation quantity of light may become the optimal.
[0009] Opposite arrangement of point light source 2 -- which consisted of white LED chips is carried out at optical plane-of-incidence 1a prepared in the edge section of a light guide plate 1. This example mounts four white LED chips as point light source 2 -- on a substrate 21. This white LED chip holds three LED, R, G, and B, in one package, and should just use what was constituted so that outgoing radiation of the white light might be carried out, and the thing which constituted monochromatic LED using the fluorescent material so that the outgoing radiation light from LED might be changed into the white light. For example, what is necessary is just to use a YAG (yttrium aluminum garnet) system fluorescent material as this fluorescent material, when GaN system blue LED is used.
[0010] The light reflex side 11 is established in the side perpendicularly located to point light source 2 -- of a light guide plate 1. In order to prevent light revealing this light reflex side 11 and to raise reflective effectiveness, dot printing is performed or the cone-like hollow is formed.
[0011] The optical outgoing radiation side 12 is established in the light reflex side 11 of a light guide plate 1, and the side which counters. And the light from each LED of the point light source 2 reflects on the light reflex side 11 or three side faces 13 of a light guide plate 1, and outgoing radiation is carried out as a synthetic light in which most incident light finally has uniform directivity from the optical outgoing radiation side 12.
[0012] As an ingredient of the light guide plate 1 mentioned above, it is chosen from translucency ingredients and the resin of an acrylic or a polycarbonate is usually used. The configurations of a light guide plate 1 are an parallel plate and a cross-section wedge plate, and, as for the thickness, an about 1-5mm thing is usually used.
[0013] As shown in drawing 2 , the reflective sheet 5 is formed so that a light guide plate 1 may be wrapped in except for the optical outgoing radiation side 12 of a light guide plate 1. That is, the reflective sheet 5 is arranged so that a light guide plate 1 may be wrapped in including the reflector 11 of a light guide plate 1, and three side faces 13. And between the optical plane-of-incidence 1a sides of the reflective sheet 5 and light guide plate 1, the space 6 surrounded with the reflective sheet 5 is formed. This reflective sheet 5 and light guide plate 1 are being fixed by the glue lines 8, such as a double-sided tape and adhesives.
[0014] As shown in drawing 2 , the insertion opening 7 which inserts the point light source 2 which consists of LED is formed in the location which stands face to face against the light guide plate 1 of the space surrounded with the reflective sheet 5. Moreover, it has the composition that the diffusion sheet 3 and the lens sheet 4 have been arranged on the top face of the optical outgoing radiation side 11 of a light guide plate 1. Even if a sheet configuration is reverse in the sequence which one sheet or two sheets are sufficient as, and is piled up, it is good.
[0015] And point light source 2 -- mounted in the substrate 21 stands face to face against each insertion opening 7 -- prepared in the reflective sheet 5 fixed to the light guide plate 1, respectively, and is inserted into space 6 from the insertion opening 7. And the substrate 21 with which each LED was mounted in the outer frame which is located in the outside of a light guide plate 1, and which is not illustrated is fixed with a screw stop or adhesives, and point light source 2 -- is arranged in the predetermined location of a light guide plate 1.
[0016] Each LED light from the point light source 2 goes into the interior of a light guide plate 1, and it is reflected in respect of [13] the light reflex pattern prepared in the light reflex side 11, or three side edges, it repeats focusing, outgoing radiation is carried out to the diffusion plate 3 from the optical outgoing radiation side 12 of a light guide plate 1, with the lens sheet 4, it diffuses homogeneity etc. in direction and outgoing radiation is carried out to desired include-angle within the limits as a synthetic light. This lens sheet 4 is approached and a liquid crystal display panel is arranged.
[0017] As described above, a light guide plate 1 is wrapped in the reflective sheet 5, and the space 6 which inserts the point light source 2 in optical plane-of-incidence side 1a is formed. And since point light source 2 -- is inserted in the insertion opening 7 and it is attached, it is the point light source 2. -- The reflective sheet 5 will exist in between. Consequently, the thing of point light source 2 -- which substrate 21 front face of a between will be covered with the reflective sheet 5, and optical effectiveness falls under the amorous glance of a substrate 21 or the effect of wearing components

can be prevented. Moreover, since it is the structure which encloses a light guide plate 1 with the reflective sheet 5, it can prevent that light leaks from both the sides of the point light source 2.
[0018] By the way, since one lamp is usually used for one equipment in the case of the surface light source equipment using a cold cathode tube lamp, there is little brightness nonuniformity on an optical outgoing radiation side, and there are also comparatively few color tone differences between lamps.
[0019] Since brightness nonuniformity and color tone nonuniformity tend to be conspicuous, without becoming continuation luminescence since two or more point light sources are usually used for one equipment to it in the case of the surface light source equipment using the point light sources, such as an LED component, there is also a disadvantageous field compared with the surface light source equipment using a cold cathode tube lamp.
[0020] Furthermore, the cost cut as a back light unit is also called for. The LED component which are the easiest to reduce in the components which constitute a back light has attracted attention. In recent years, it is also a cause that the possibility of number reduction of LED components is becoming large with improvement in the brightness of a white LED component. As there are many LED components, it is hard to come out of the difference between the point light sources and is more advantageous, but since it becomes a opposite side cost rise, LED component reduction and the back light engine performance conflict.
[0021] When LED components are reduced, the following problems occur.
[0022] ** If the number of an LED component becomes fewer even if it uses the LED component of quantity brightness, total brightness will fall.
** LED component spacing spreads inevitably. For example, when arranging six LED components at 25mm spacing, if it is regular intervals, it will be set to about 5mm, but since it is set to about 8.3mm at equal intervals in arranging four LED components, the so-called firefly phenomenon in which it is brightly conspicuous near the LED component locally occurs.
** When spacing becomes large, the LED intermittent part where an LED component does not exist becomes black locally. It is also promoting the above-mentioned firefly phenomenon especially.
** The brightness nonuniformity on a back light increases. That is, in order to become dark locally and for the brightness of the part to fall like the above-mentioned **, the difference of the maximum brightness on a back light and the minimum brightness increases.
** It is visually influential. **, the above-mentioned **, and ** are phenomena to the extent that it can distinguish clearly also by human being's eyes. It will be very conspicuous especially after equipping with a liquid crystal panel.
[0023] As an approach of solving the above problem from a light guide plate side, conventionally, in the light entering surface of a light guide plate, you make it scattered on right and left just before the light from the point light source which performs formation, i.e., knurling tool processing, and consists of an LED component carries out ON light of the continuous concave convex groove to a light guide plate, and the technique which prevents a firefly phenomenon is known.
[0024] With constituting as mentioned above, surely, appearance becomes good, but on the other hand it has the fault that brightness falls. Furthermore, also on the occasion of metal mold molding, when pattern processing of a reflector was performed, the nest of the aforementioned light entering surface and the 2nd page in all was needed, and there was a fault that the manufacture became complicated.
[0025] Moreover, similarly, as a solution from a light guide plate side, as shown in drawing 3 (a), **** which becomes the LED intermittent part of the reflector 11 of a light guide plate 1 from 15c concave heights of sector pattern 15b or a triangle pattern is strengthened, and the method of calling in light into the low brightness part of an LED intermittent part is learned. When it becomes spacing exceeding 8.5mm, it becomes impossible to cover brightness nonuniformity, although there will be no depression of the brightness like the shape of toothing of light guide plate 1 end-face 1a which was mentioned above, but on the other hand a limit will be in arrangement spacing of an LED component and it will be based on light guide plate size etc., if it is this approach.
[0026] Moreover, in order to set the LED component of both ends as central approach to a slight degree in order to raise central brightness, or to raise [for example,] brightness nonuniformity conversely in case of this approach to change arrangement spacing of an LED component a little

When the **** activity which extends the LED component of both ends conversely occurred, there was a disadvantageous field that redesigning the pattern of a reflector each time etc. did not have effective accommodation -- it becomes impossible to correspond to a customer's needs etc.. That is, it is the thing to say that there is only one light guide plate corresponding to one LED component spacing. In addition, gradation pattern 15a is also given to the reflector of a light guide plate 1.
[0027]
[Problem(s) to be Solved by the Invention] As described above, in order to avoid the firefly phenomenon by the side of the light source accompanying LED point light source number reduction, knurling tool processing is performed to light entering surface 1a of a light guide plate 1, or a cure, such as performing concavo-convex processing to the LED intermittent section near the light source of a reflector 11, is implemented. In this case, surely knurling tool processing of the aforementioned light entering surface decreases the firefly phenomenon from the LED point light source, and although it is effective in raising appearance, it has the problem that the brightness to an outgoing radiation side falls. Furthermore, the irregularity of the LED intermittent section of a reflector 11 needed to make the magnitude of a pattern change by arrangement of an LED component each time, and the fault that prompt correspondence could not be performed had it on the occasion of modification of the light source.
[0028] This invention aims at offering the surface light source equipment which can reduce the number of the point light sources, such as an LED component, and can cancel brightness nonuniformity in view of the above-mentioned situation.
[0029]
[Means for Solving the Problem] First, it explains from the premise of this invention. This invention is premised on reducing LED components for cost reduction. For this reason, they are three LED components 2 in the form where the free space for one LED component is compensated as shown in drawing 3 (b) when LED components are reduced from four pieces to three pieces, as shown in the below-mentioned operation gestalt. -- The arrangement which narrows spacing a little is taken. However, if it arranges in this way, since two LED components 2 and 2 arranged at the edge will serve as a central twist, the both ends by the side of the light source become dark, and the so-called firefly phenomenon which looks brightly near the LED component 2 locally conversely appears. Since the number of this phenomenon of an LED component decreased, it happens. Furthermore, since it became large compared with the case where spacing of the LED component 2 is four pieces, the pin center,large brightness on the most important back light will fall, and a cure, such as raising the quantity of light in an LED simple substance the way things stand, is needed.
[0030] That is, arrangement of LED component 2 -- to which the number becomes fewer, and LED component spacing opens when the LED component of both ends becomes central approach simultaneously, and central brightness falls must be taken.
[0031] However, it sees from the supply side of LED, even if it is able to supply that it is impossible to supply only an LED component with the large quantity of light, and temporarily, sorting of an LED component, i.e., the degree article of Takamitsu, is adopted, and only the method of omitting other low luminous-intensity LED components is considered, and a price hike is not avoided. In the present skill level, even if dispersion in luminous intensity is large and still adopts which **** LED component, fixed brightness must be realized on a back light.
[0032] It turns out that LED component spacing is narrowly set up all at once in order to compensate the above difficulty, and near the both ends of an LED substrate becomes dark shortly even if it sets up in this way when reservation and the cure against a firefly of pin center,large brightness are performed first (E39 of drawing 3 (c)). Therefore, even if pin center,large brightness is secured, the brightness of both ends will fall victim.
[0033] In other words, the location of one center was kept constant among three LED components, changing the same LED component 2 -- for a substrate, in order to bring only both ends close to an end face for a while and to find out the conditions with which the darkness of both sides is compensated, without reducing central brightness not much, spacing was replaced with and the optical property was measured. Consequently, like E31 of drawing 3 (b), although LED spacing is set to 12.5mm, with this spacing, an umbra is conspicuous in the LED intermittent section, when two centers are reduced to one piece with a setup of both ends in the present state (i.e., a spacing setup of

four LGTs). Moreover, as mentioned above, if it is E31 (9.5mm) of drawing 3 (b), the present reflective triangular pattern will be overlapped, a bright section concentrates, and appearance gets worse.
[0034] Therefore, although pin center,large brightness fell a little, when the umbra of brightness nonuniformity and both ends etc. was synthesized and evaluated, it was decided as E311 of drawing 3 (d) as LED arrangement spacing with the most sufficient balance that it would be 11mm.
[0035] Moreover, as shown in the pattern Fig. which showed the pattern of the reflector 11 of the light guide plate 1 used for this invention to drawing 3 , triangle pattern 15c and sector pattern 15b which enlarged granularity are given to the LED intermittent section. Although this pattern was conventionally developed as a thing for LED component 4 LGTs, it was understood that it can apply even if it uses the number of an LED component as three LGTs here. It was proved by the below-mentioned cure against a firefly that it can be further made to serve a double purpose.
[0036] Make this invention into what was made based on the above-mentioned fact, and incidence of the light is carried out from two or more point light sources arranged to one side of the side edge side of a light guide plate. It is surface light source equipment which reflects in respect of the light reflex of a light guide plate, and emits light from the optical outgoing radiation side of a light guide plate, and is characterized by forming the vertical prism side in the part of said optical outgoing radiation side which a firefly phenomenon generates at least at said point light source.
[0037] Said prism side is good for the light reflex side of said light guide plate which may prepare all over an optical outgoing radiation side, and is located in the intermittent section of said point light source to perform concavo-convex processing.
[0038] As mentioned above, in the surface light source equipment which constitutes a back light etc., in the light guide plate outgoing radiation side at the time of reducing the number of the point light source (LED component), this invention gives vertical prism first to the point light source bearing in mind preventing the brightness fall by the irregularity of a light entering surface, is extending the light with which it is dotted from the point light source in a longitudinal direction, and plans problem solvings, such as brightness nonuniformity.
[0039] Moreover, even if the prism (knurling tool processing) of an outgoing radiation side is not the whole surface, it can also be limited only to the range in which the firefly phenomenon from the LED light source appears.
[0040] With the prism (knurling tool processing) of an outgoing radiation side, the firefly phenomenon by the side of a light entering surface is diffused, and its appearance improves in the condition of not reducing high brightness.
[0041]
[Embodiment of the Invention] Hereafter, with reference to a drawing, it explains per gestalt of implementation of this invention. The perspective view showing the outline configuration of the surface light source equipment which drawing 4 requires for the 1st operation gestalt of this invention, and drawing 5 are the expansion perspective views of the optical outgoing radiation side which is the important section of this invention. In addition, the same sign is given to the same part as the conventional example.
[0042] As shown in drawing 4 , the surface light source concerning this invention consists of point light source 2 --, various control circuits (not shown), etc. which consisted of a light guide plate 1 and LED.
[0043] Opposite arrangement is carried out and point light source 2 -- which consisted of white LED chips is in optical plane-of-incidence 1a prepared in the edge section of a light guide plate 1. With the gestalt of this operation, on a substrate 21, the LED components as the point light source 2 are reduced, and three white LED chips are mounted.
[0044] The light reflex side 11 is established in the side perpendicularly located to point light source 2 -- of a light guide plate 1. In order to prevent light revealing this light reflex side 11 and to raise reflective effectiveness, gradation pattern 15a shown in drawing 3 is given, and sector pattern 15b and triangle pattern 15c are given to the LED component intermittent section. The granularity of these patterns 15b and 15c is set up identically to the rudest part of the above-mentioned gradation pattern 15a.
[0045] The optical outgoing radiation side 12 is established in the light reflex side 11 of a light guide

plate 1, and the side which counters. And the light from each LED of the point light source 2 reflects on the light reflex side 11 or three side faces 13 of a light guide plate 1, and outgoing radiation is carried out as a synthetic light in which most incident light finally has uniform directivity from the optical outgoing radiation side 12.

[0046] As an ingredient of the light guide plate 1 mentioned above, it is chosen from translucency ingredients and the resin of an acrylic or a polycarbonate is usually used. The configurations of a light guide plate 1 are an parallel plate and a cross-section wedge plate, and, as for the thickness, an about 1-5mm thing is usually used.

[0047] Moreover, as other translucency ingredients, transparent resin, such as acrylate, such as urethane acrylate of the independent or the many organic functions which constructed the bridge with thermoplastics, such as polyester, such as a copolymer, polyethylene terephthalate, and polybutylene terephthalate, a polycarbonate, polystyrene, and the poly methyl pentene, ultraviolet rays, or an electron ray of acrylic ester, such as Pori methacrylic acid methyl and polymethylacrylate, or methacrylic acid ester, and polyester acrylate, and unsaturated polyester, transparent glass, a transparent ceramic, etc. are used.

[0048] Each LED light from the point light source 2 goes into the interior of a light guide plate 1, and it is reflected in respect of [13] the light reflex pattern prepared in the light reflex side 11, or three side edges, it repeats focusing, outgoing radiation is carried out to a diffusion plate (not shown) from the optical outgoing radiation side 12 of a light guide plate 1, with a lens sheet (not shown), it diffuses homogeneity etc. in direction and outgoing radiation is carried out to desired include-angle within the limits as a synthetic light. This lens sheet is approached and a liquid crystal display panel is arranged.

[0049] Next, the cure against a firefly phenomenon when the point light source 2 which consists of an LED component becomes three LGTs is explained. By the above-mentioned approach, even if a firefly phenomenon discovers the conditions by which are not removed completely, for example, a firefly cannot be seen further easily due to the Hayes value of a diffusion sheet, or the conditions of a lens sheet, it cannot be removed completely.

[0050] Moreover, there is a limit in the pattern of the reflector 11 of the light guide plate 1 of the LED component intermittent section taking out effectiveness. Therefore, an appropriate cure is required for the cure against a firefly phenomenon beyond this.

[0051] This invention was made into what was made in view of the above-mentioned situation, and as shown in drawing 4 and drawing 5 , it has given the vertical prism 16 to the point light source 2 which consists of an LED component all over outgoing radiation side of light guide plate 1 12. That is, as shown in drawing 5 which is the enlarged drawing of A part of drawing 4 , the prism side 16 is formed all over the optical outgoing radiation side 12. With this operation gestalt, 135 prism include angles and height set 10 micrometers and a prism pitch as 50 micrometers. Thus, by giving the set-up prism, the light with which it is dotted from the point light source 2 which consists of an LED component can be extended in a longitudinal direction, and problem solvings, such as brightness nonuniformity, can be planned. And light spreads also round the part at which the above-mentioned light does not arrive, and it has the description that a firefly phenomenon decreases sharply in the form multiplied by the pattern effectiveness of the reflector 11 of a light guide plate 1.

[0052] Although the above views do not carry out illustration, they are applicable also to a 4 inch back light, for example. Although the 4 inch back light is using the 8-12 point light sources which consist of an LED component in the present condition, even if it faces the above LED number reduction, it cannot be overemphasized that this invention is applicable.

[0053] Next, it explains per 2nd operation gestalt of this invention. Although it is the same as that of the 1st operation gestalt, as shown in drawing 6 and drawing 7 , the overall configuration of this 2nd operation gestalt does not give the prism of the outgoing radiation side 12 to the whole surface, but concentrates only an about two point light source part, and gives prism 16a. The gestalt of prism is constituted so that a slot may become shallow gradually, as it keeps away from a point light source 2 side. That is, the optical effect of the muscle of the slot terminal point in the case of a configuration which the slot has finished on the way etc. is avoided.

[0054] With constituting in this configuration, in the place near the point light source 2 which a firefly phenomenon produces most, it follows on a firefly phenomenon decreasing and the property

of a slot being less necessary is used as a slot is deep and it separates from the light source.
[0055] In addition, about whole surface prism, as shown in drawing 8 , drawing 9 , and drawing 10 , it turns out that it is not what influences greatly the brightness and brightness nonuniformity of the whole back light. Drawing 8 shows the result of having measured the optical property by the existence of whole light guide plate outgoing radiation side surface prism by measurement 9 point, and what drawing 9 expressed the luminance distribution by whole light guide plate outgoing radiation side surface prism with the relative value to, and drawing 10 express with a relative value the luminance distribution by what does not form prism in a light guide plate outgoing radiation side. It is thought that its scattering effect of the light of the light guide plate itself is large, and its wait of the spreading effect by outgoing radiation side prism is low since the light guide plate in this operation gestalt used the dispersion light guide plate. Effectiveness is very large if it is a clear light guide plate.
[0056]
[Effect of the Invention] As explained above, in the surface light source equipment which constitutes a back light etc., in the light guide plate outgoing radiation side at the time of reducing the number of the point light source (LED component), this invention gives vertical prism to the point light source, can avoid the firefly phenomenon with which it was dotted near the point light source, and can plan problem solvings, such as brightness nonuniformity, by extending the light with which it is dotted from LED in a longitudinal direction.

[Translation done.]

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is the perspective view showing the condition of having equipped with the reflective sheet in the light guide plate of conventional surface light source equipment.
[Drawing 2] It is the sectional view showing the outline configuration of conventional surface light source equipment.
[Drawing 3] It is the explanatory view showing number reduction of the LED components in connection with this invention, and decision transition of 3 LGT spacing.
[Drawing 4] It is the perspective view showing the outline configuration of the surface light source equipment concerning the 1st operation gestalt of this invention.
[Drawing 5] It is the expansion perspective view of the outgoing radiation side which is the important section of this invention.
[Drawing 6] It is the perspective view showing the outline configuration of the surface light source equipment concerning the 1st operation gestalt of this invention.
[Drawing 7] It is the expansion perspective view of the outgoing radiation side which is the important section of this invention.
[Drawing 8] It is drawing showing the result of having measured the optical property by the existence of whole light guide plate outgoing radiation side surface prism by measurement 9 point.
[Drawing 9] It is drawing which expressed the luminance distribution by whole light guide plate outgoing radiation side surface prism with the relative value.
[Drawing 10] It is drawing which expressed with the relative value the luminance distribution by what does not form prism in a light guide plate outgoing radiation side.
[Description of Notations]
1 Light Guide Plate
2 Point Light Source (LED Component)
11 Light Reflex Side
12 Optical Outgoing Radiation Side
16 Prism Side

[Translation done.]

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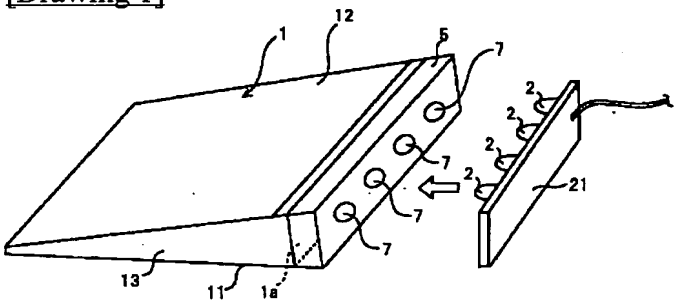
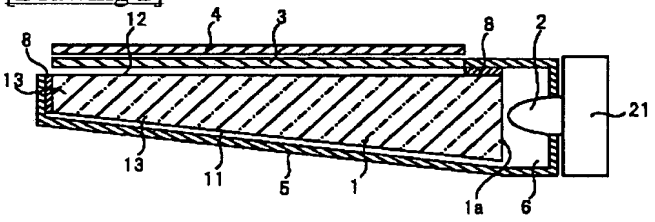
DRAWINGS

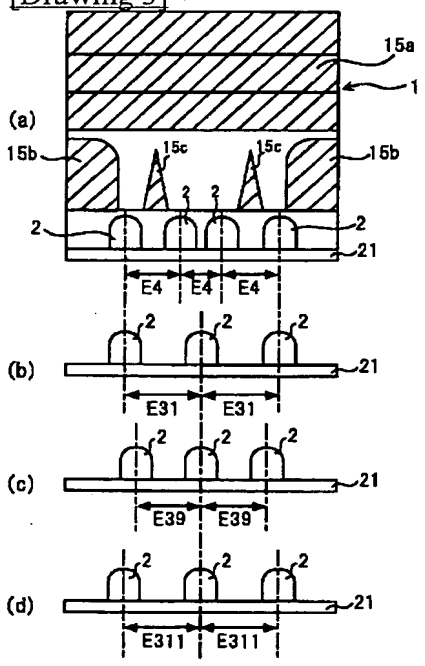
[Drawing 1]



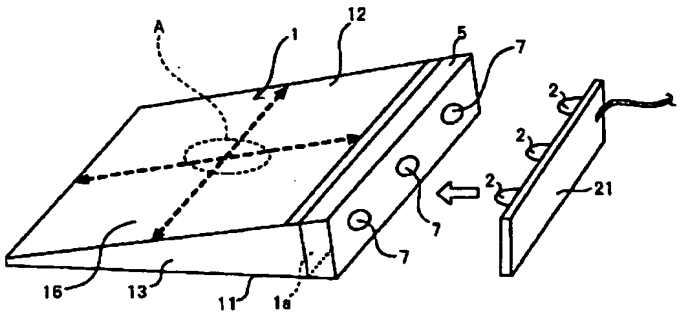
[Drawing 2]



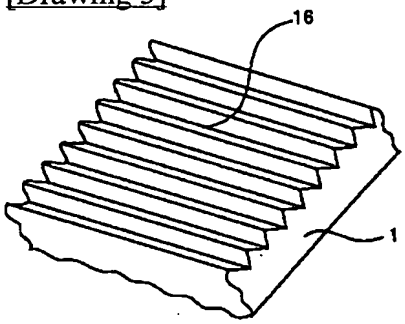
[Drawing 3]



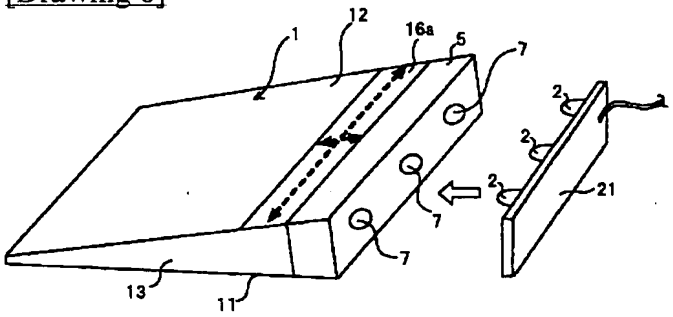
[Drawing 4]



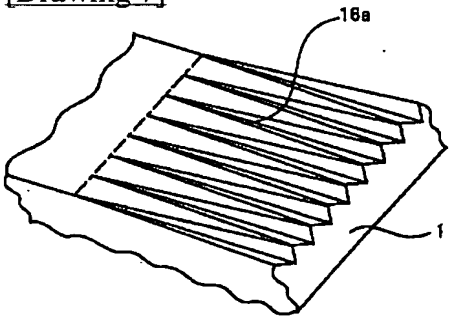
[Drawing 5]



[Drawing 6]



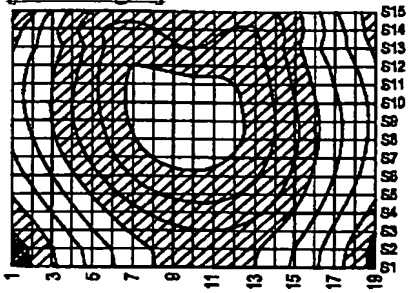
[Drawing 7]



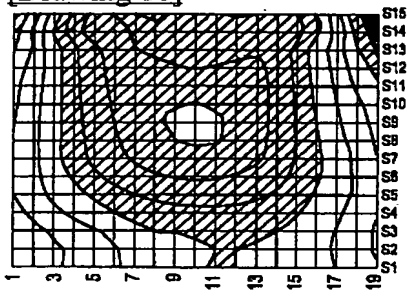
[Drawing 8]

測定位置	プリズムなし	本発明プリズム
中央	2321	2386
上	2025	2130
右上	1845	1787
右	2011	2011
右下	2018	1989
下	2155	2198
左下	1884	1899
左	1964	1989
左上	1917	1859
平均	2016	2028
Max	2321	2386
Min	1845	1787
輝度ムラ	79%	75%

[Drawing 9]



[Drawing 10]



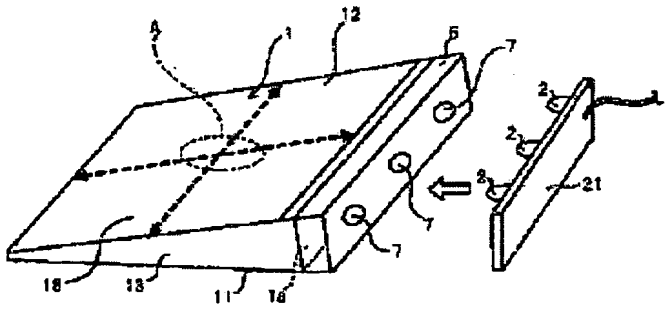
[Translation done.]

PLANE LIGHT SOURCE DEVICE

Publication number: JP2003141918
Publication date: 2003-05-16
Inventor: YAMAMURA TORU
Applicant: SANYO ELECTRIC CO
Classification:
- international: ***G02B6/00; F21V8/00; G02F1/13357;*** *F21Y101/02;* **G02B6/00; F21V8/00; G02F1/13;** (IPC1-7): F21V8/00; G02B6/00; G02F1/13357; F21Y101/02
- european:
Application number: JP20010336228 20011101
Priority number(s): JP20010336228 20011101

Report a data error here

Abstract of **JP2003141918**
PROBLEM TO BE SOLVED: To provide a plane light source device with the number of point light sources such as an LED element reduced and with brightness unevenness eliminated. SOLUTION: With the plane light source device which lets in light from a plurality of point light sources 2... arranged at one of the side end faces of a light guide plate 1, reflects it with a light reflecting face 11 of the light guide plate 1 and emits it from a light-emitting face 12 of the light guide plate 1, a prism face 16 is formed on the light-emitting face 12 in the direction vertical to the point light sources 2.



(19)日本国特許庁（ＪＰ）　(12)公開特許公報（Ａ）　(11)特許出願公開番号
特開2003－141918
（P2003－141918A）
(43)公開日　平成15年５月16日(2003.5.16)

(51)Int.Cl.'		識別記号	FI		テーマコード'(参考)
Ｆ２１Ｖ	8/00	６０１	Ｆ２１Ｖ	8/00	６０１Ａ　２Ｈ０３８
					６０１Ｃ　２Ｈ０９１
					６０１Ｄ
					６０１Ｅ
Ｇ０２Ｂ	6/00	３３１	Ｃ０２Ｂ	6/00	３３１

審査請求　未請求　請求項の数３　ＯＬ　（全　７　頁）　最終頁に続く

(21)出願番号　特願2001－336228(P2001－336228)
(22)出願日　平成13年11月１日(2001.11.1)

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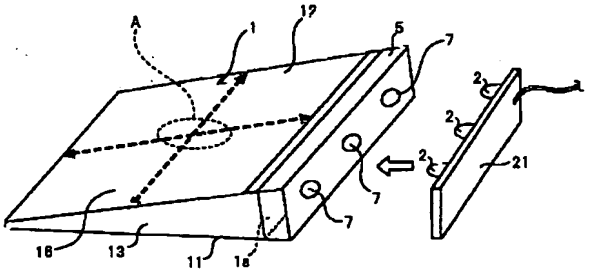
Ｆターム(参考)　2H038 AA52 AA55 BA06
2H091 FA21Z FA23Z FA45Z FD04
FD07 FD12 FD14 FD22 LA03
LA11 LA12 LA18

(54)【発明の名称】　面光源装置

(57)【要約】
【課題】　この発明は、ＬＥＤ素子などの点光源の数を削減し、且つ輝度ムラを解消することができる面光源装置を提供することを課題とする。
【解決手段】　この発明は、導光板１の側端面の一方に配置した複数の点光源２…から光を入射し、導光板１の光反射面１１で反射し、導光板１の光出射面１２から光を放出する面光源装置であって、前記光出射面１２に前記点光源２に垂直方向のプリズム面１６が形成されている。



【特許請求の範囲】
【請求項１】　導光板の側端面の一方に配置した複数の点光源から光を入射し、導光板の光反射面で反射し、導光板の光出射面から光を放出する面光源装置であって、前記光出射面の少なくとも蛍現象が発生する箇所に前記点光源に垂直方向のプリズム面が形成されていることを特徴とする面光源装置。
【請求項２】　前記プリズム面は光出射面の全面に設けられていることを特徴とする請求項１に記載の面光源装置。
【請求項３】　前記点光源の間欠部に位置する前記導光板の光反射面に凹凸加工が施されていることを特徴とする請求項１又は２に記載の面光源装置。
【発明の詳細な説明】
【０００１】
【発明の属する技術分野】この発明は、発光ダイオード（ＬＥＤ）素子のような発光素子からなる点光源の集合体からなり、主として液晶表示装置の照明装置に用いられる面光源装置に関する。
【０００２】
【従来の技術】近年、電子機器の軽量化、小型化及び低消費電力化を図る技術は著しく発展してきている。この技術の流れの中で、液晶表示装置に代表される非発光表示デバイスを用いることにより、電子機器が軽量化、小型化され、しかも低消費電力化されてきている。
【０００３】液晶表示装置としては、透過型と反射型とがあり、透過型の液晶表示装置には、液晶表示装置を裏側から照明する照明装置、いわゆるバックライトが設けられ、反射型の液晶表示装置には、液晶表示装置を表側から照明する、いわゆるフロントライトが設けられている。
【０００４】液晶表示装置用の面光源装置として、透光性平板を導光体としたエッジライト方式のものが知られている。このような面光源装置では、透明な平行平板や断面楔形平板からなる導光板の側端面、すなわちエッジ部の一方から光を入射させ、導光板の全域に満遍なく光を伝播させ、その伝播した光の一部を導光板裏面の光反射部材で拡散反射光となし、導光板表面から拡散光を放出する。
【０００５】液晶表示装置用の面光源装置として用いられるエッジライト方式の導光板は、導光板の厚みを薄くできることや、構成を簡単にできるため広く利用されている。
【０００６】エッジライト方式の面光源装置の多くは、光源として冷陰極管ランプが用いられ、導光板のエッジ部に冷陰極管ランプが設けられている。しかし、近年携帯型装置が普及し、低消費電力化の観点などから冷陰極管ランプに比べ消費電力が少ない発光ダイオード（ＬＥＤ）光源等の点状光源を用いたものが実用化されている。
【０００７】図１及び図２に従来のＬＥＤ素子を用いた面光源装置を示す。図１は、従来の面光源装置の導光板に反射シートを装着した状態を示す斜視図、図２は、従来の面光源装置の概略構成を示す断面図である。
【０００８】図１及び図２に示すように、この面光源装置は、導光板１、ＬＥＤで構成された点光源２…及び各種制御回路（図示せず）などで構成されている。この制御回路には、例えば導光板１の光出射面１２から出射される光の総量を検知して、出射光量が最適になるように点光源２に電力を調整して供給する回路も含まれている。
【０００９】導光板１のエッジ部に設けられた光入射面１ａには、白色ＬＥＤチップで構成された点光源２…が対向配置されている。この例は、基板２１上に点光源２…として４つの白色ＬＥＤチップを実装している。この白色ＬＥＤチップは、例えば、Ｒ、Ｇ、Ｂの３つのＬＥＤを１つのパッケージに収容して、白色光を出射させるように構成したものや、単色のＬＥＤを蛍光物質を用いてＬＥＤからの出射光を白色光に変換するように構成したものを用いればよい。例えば、この蛍光物質としては、ＧａＮ系青色ＬＥＤを用いた場合には、ＹＡＧ（イットリウム・アルミニウム・ガーネット）系蛍光物質を用いればよい。
【００１０】導光板１の点光源２…に対して垂直方向に位置する側には、光反射面１１が設けられている。この光反射面１１は、光が漏洩するのを防ぎ反射効率を高める為に、ドット印刷を行ったりコーン状の窪みが形成されている。
【００１１】導光板１の光反射面１１と対向する側には光出射面１２が設けられている。そして、点光源２の各ＬＥＤからの光が、光反射面１１や導光板１の３つの側面１３で反射して、入射光の殆どが最終的に光出射面１２から均一な指向性を有する合成光として出射される。
【００１２】前述した導光板１の材料としては、透光性材料の中から選択され、通常はアクリルまたはポリカーボネートの樹脂が用いられる。導光板１の形状は平行平板や断面楔形平板で、その厚みは、通常１～５ｍｍ程度のものが用いられる。
【００１３】図２に示すように、導光板１の光出射面１２を除いて導光板１を包み込むように反射シート５が設けられている。すなわち、導光板１の反射面１１及び３つの側面１３を含み導光板１を包み込むように反射シート５が配置されている。そして、その反射シート５と導光板１の光入射面１ａ側との間には、反射シート５で囲まれた空間６が設けられている。この反射シート５と導光板１とは両面テープ、接着剤等の接着層８により固定されている。
【００１４】図２に示すように、反射シート５で囲まれた空間の導光板１に対峙する場所にＬＥＤからなる点光源２を差し込む挿入口７が設けられている。また、導光

板１の光出射面１１の上面には、拡散シート３、レンズシート４が配置された構成となっている。シート構成は、１枚でも２枚でも良く、また、重ねる順序を逆にしても良い。

【００１５】そして、基板２１に実装された点光源２…は、導光板１に固定された反射シート５に設けられた各挿入口７…にそれぞれ対峙し、その挿入口７から空間６内に挿入されている。そして、導光板１の外側に位置する図示しない外枠に各ＬＥＤが実装された基板２１をネジ止め又は接着剤などで固定され、導光板１の所定位置に点光源２…が配置される。

【００１６】点光源２からの各ＬＥＤ光は導光板１の内部に入り、光反射面１１に設けられた光反射パターンや３つの側端面１３で反射され集束を繰り返し、導光板１の光出射面１２から拡散板３に出射され、レンズシート４によって所望の角度範囲内に均一等方的に拡散されて合成光として出射される。このレンズシート４に近接して液晶表示パネルが配置される。

【００１７】上記したように、導光板１を反射シート５で包み込み、光入射面側１ａに点光源２を差し込む空間６が設けられる。そして、その挿入口７に点光源２…が差し込まれて取り付けられるので、点光源２…の間は反射シート５が存在することになる。この結果、点光源２…の間の基板２１表面は反射シート５で覆われることになり、基板２１の色目や装着部品の影響で光効率が低下することを防止できる。また、反射シート５で導光板１を囲い込む構造であるので、点光源２の両サイドから光が漏れるのを防止できる。

【００１８】ところで、冷陰極管ランプを用いた面光源装置の場合、通常、一つの装置に一本のランプが用いられるため、光出射面上での輝度ムラは少なく、また、ランプ間の色調差も比較的少ない。

【００１９】それに対して、ＬＥＤ素子などの点光源を用いた面光源装置の場合、通常、一つの装置に複数個の点光源が用いられるため、連続発光とはならずに輝度ムラや色調ムラが目立ちやすいため、冷陰極管ランプを用いた面光源装置に比べて不利な面もある。

【００２０】更に、バックライトユニットとしてのコストダウンも求められている。バックライトを構成する部品の中で最も削減しやすいＬＥＤ素子が注目されてきている。近年、白色ＬＥＤ素子の輝度の向上に伴い、ＬＥＤ素子の個数削減の可能性が大きくなってきたことも一因である。ＬＥＤ素子は多ければ多いほど点光源間の差が出にくく有利であるが、反面コストアップとなるため、ＬＥＤ素子削減とバックライト性能とは相反するものとなる。

【００２１】ＬＥＤ素子を削減した場合、以下の問題が発生する。

【００２２】①高輝度のＬＥＤ素子を用いてもＬＥＤ素子の個数が減ればトータル輝度が低下する。

②ＬＥＤ素子間隔が必然的に広がる。例えば、２５ｍｍ間隔に６個のＬＥＤ素子を配置する場合、等間隔であれば約５ｍｍとなるが、４個のＬＥＤ素子を配置する場合には、等間隔で約８．３ｍｍとなるため、ＬＥＤ素子近傍が局部的に明るく目立つ、いわゆる蛍現象が発生する。

③間隔が広くなった場合、ＬＥＤ素子が存在しないＬＥＤ間欠箇所が局部的に黒くなる。前述の蛍現象をことさら助長することにもなる。

④バックライト上の輝度ムラが増大する。すなわち、前述の③のように、局部的に暗くなり、その部分の輝度が低下するために、バックライト上の最大輝度と最小輝度との差が増大する。

⑤視覚的にも影響がある。特、前述の②及び③は、人間の目でもはっきりと判別できるほどの現象である。特に、液晶パネルを装着した後は非常に目立ってしまう。

【００２３】以上の問題を導光板側から解決する方法として、従来、導光板の入光面において、連続する凹凸溝を形成、すなわち、ローレット加工を施し、ＬＥＤ素子からなる点光源からの光が導光板に入光する直前に左右に散乱させ、蛍現象を未然に防ぐ技術が知られている。

【００２４】上記のように構成することで、確かに見栄えはよくなるが、その反面輝度が低下するという欠点がある。更に、金型成型の際にも、例えば反射面のパターン加工を施すような場合、前記の入光面と併せて２面の入れ子が必要となり、その製造が煩瑣になるという欠点があった。

【００２５】また、同じく導光板側からの解決策として、図３（ａ）に示すように、導光板１の反射面１１のＬＥＤ間欠部分に扇形パターン１５ｂや三角形パターンの１５ｃ凹凸部からなる濁しを強くして、ＬＥＤ間欠部分の低輝度部分に光を呼び込む方法が知られている。この方法であれば、上述したような導光板１端面１ａの凹凸形状の如き輝度の落ち込みはないが、その反面ＬＥＤ素子の配置間隔に限度があり、導光板サイズなどにもよるが、８．５ｍｍを越える間隔となると輝度ムラをカバーできなくなる。

【００２６】また、この方法だと、ＬＥＤ素子の配置間隔を若干変更したい場合、例えば、中央輝度を上げるために両端のＬＥＤ素子をもう少し中央寄りに設定したり、逆に、輝度ムラを向上させるために、両端のＬＥＤ素子を逆に広げるよな作業が発生した場合、その都度反射面のパターンを設計し直すなど、顧客のニーズに対応できなくなるなど融通が利かないという不利な面があった。すなわち、１つのＬＥＤ素子間隔に対応した導光板が１つしかないといういうことである。尚、導光板１の反射面にはグラデーションパターン１５ａも施されている。

【００２７】

【発明が解決しようとする課題】上記したように、ＬＥ

Ｄ点光源個数削減に伴う光源側の蛍現象を回避するため、導光板１の入光面１ａにローレット加工を施したり、反射面１１の光源近傍のＬＥＤ間欠部に凹凸加工を施す等の対策が実施されている。この場合、前記の入光面のローレット加工は確かにＬＥＤ点光源からの蛍現象を減少させ、見栄えを向上させる効果があるが出射面への輝度が低下するという問題がある。さらに、反射面１１のＬＥＤ間欠部の凹凸は、ＬＥＤ素子の配置によってパターンの大きさをその都度変更させる必要があり、光源の変更に際して、速やかな対応ができないという欠点があった。

【００２８】この発明は、上記の事情を鑑み、ＬＥＤ素子などの点光源の数を削減し、且つ輝度ムラを解消することができる面光源装置を提供することを目的とする。

【００２９】

【課題を解決するための手段】まず、この発明の前提から説明する。この発明は、コスト低減のためＬＥＤ素子を削減することを前提としている。このため、後述の実施形態に示すように、ＬＥＤ素子を４個から３個に削減した場合に、図３（ｂ）に示すように、ＬＥＤ素子１個分の空きスペースを補う形で３個のＬＥＤ素子２…間隔を若干狭める配置をとる。ところが、このように配置すると、端に配置された２個のＬＥＤ素子２，２が中央よりとなるため、光源側の両端が暗くなり、逆にＬＥＤ素子２の近傍が局部的に明るく見える所謂蛍現象が現れる。この現象は、ＬＥＤ素子の個数が減ったために起こったものである。更に、ＬＥＤ素子２の間隔が４個の場合に比べて広くなったため、一番重要なバックライト上のセンター輝度が低下することになり、このままではＬＥＤ単体での光量を上げるなどの対策が必要となってくる。

【００３０】すなわち、ＬＥＤ素子２…の個数が減って、且つ両端のＬＥＤ素子が中央寄りになるとと同時にＬＥＤ素子間隔が開き、中央輝度が低下するような配置をとらざるを得ない。

【００３１】しかしながら、ＬＥＤの供給側から見て、光量の大きいＬＥＤ素子のみを供給するのは不可能であり、仮に供給できたとしてもＬＥＤ素子の選別、すなわち高光度品のみを採用し、他の低光度ＬＥＤ素子を切り捨てるといった方法しか考えられず、価格上昇は避けられない。現状の技術レベルでは未だ光度のばらつきが大きく、どのようなＬＥＤ素子を採用しても、一定の輝度をバックライト上で実現しなければならない。

【００３２】以上の難点を補うべく、ＬＥＤ素子間隔を一斉に狭く設定し、まず、センター輝度の確保及び蛍対策を行った場合（図３（ｃ）のＥ３９）、このように設定しても、今度はＬＥＤ基板の両端付近が暗くなってしまうことが分かる。従って、センター輝度が確保されたとしても両端の明るさが犠牲になってしまう。

【００３３】言い換えれば、３個のＬＥＤ素子のうち中央１個の位置を一定に保って、両端のみ少し端面に近づけたり、また、中央輝度をあまり低下させずに、且つ両サイドの暗さを補う条件を見出すために、同じＬＥＤ素子２…を基板に付け替えながら、間隔を代えて光学特性を測定した。その結果、両端を現行のまま、すなわち、４灯の間隔設定のままで、中央２個を１個に減らした場合、図３（ｂ）のＥ３１のように、ＬＥＤ間隔は１２．５ｍｍとなるが、この間隔のままでは、ＬＥＤ間欠部に暗部が目立つ。また、前述のように、図３（ｂ）のＥ３１（９．５ｍｍ）だと現行の反射三角パターンに重複し、明部が集中し、見栄えが悪化する。

【００３４】従って、センター輝度はやや低下するものの、輝度ムラ及び両端の暗部等を総合して評価したところ、最もバランスのいいＬＥＤ配置間隔として、図３（ｄ）のＥ３１１として、１１ｍｍに決定した。

【００３５】また、この発明に用いている導光板１の反射面１１のパターンは、図３に示したパターン図のように、ＬＥＤ間欠部に粗さを大きくした三角形パターン１５ｃ及び扇形パターン１５ｂが施されている。このパターンは、従来ＬＥＤ素子４灯用のものとして開発されたものであるが、ここで、ＬＥＤ素子の個数を３灯にしても適用可能であることが分かった。後述の蛍対策により、更に兼用できることが実証された。

【００３６】この発明は、上記した事実に基づいてなされたものにして、導光板の側端面の一方に配置した複数の点光源から光を入射し、導光板の光反射面で反射し、導光板の光出射面から光を放出する面光源装置であって、前記光出射面の少なくとも蛍現象が発生する箇所に前記点光源に垂直方向のプリズム面が形成されていることを特徴とする。

【００３７】前記プリズム面は光出射面の全面に設けてもよく、また、前記点光源の間欠部に位置する前記導光板の光反射面に凹凸加工を施すとよい。

【００３８】上記のように、この発明は、バックライトなどを構成する面光源装置において、点光源（ＬＥＤ素子）の個数を減らした場合の導光板出射面において、まず、入光面の凹凸による輝度低下を防止することを念頭に置き、点光源に垂直方向のプリズムを施し、点光源から点在する光を横方向に広げることで、輝度ムラ等の問題解決を図る。

【００３９】また、出射面のプリズム（ローレット加工）は全面でなくてもＬＥＤ光源からの蛍現象が現れる範囲にのみ限定することも可能である。

【００４０】出射面のプリズム（ローレット加工）により、入光面側の蛍現象は拡散され、高輝度を低下させない状態で見栄えが向上する。

【００４１】

【発明の実施の形態】以下、この発明の実施の形態につき図面を参照して説明する。図４は、この発明の第１の実施形態にかかる面光源装置の概略構成を示す斜視図、

図5は、この発明の要部である光出射面の拡大斜視図である。尚、従来例と同一部分には同一符号を付す。

【0042】図4に示すように、この発明に係る面光源は、導光板1、LEDで構成された点光源2…及び各種制御回路（図示せず）などで構成されている。

【0043】導光板1のエッジ部に設けられた光入射面1aには、白色LEDチップで構成された点光源2…が対向配置されいてる。この実施の形態では、基板21上に点光源2としてのLED素子を削減して3つの白色LEDチップを実装している。

【0044】導光板1の点光源2…に対して垂直方向に位置する側には、光反射面11が設けられている。この光反射面11は、光が漏洩するのを防ぎ反射効率を高める為に、図3に示すグラデーションパターン15aが施されており、また、LED素子間欠部には扇形パターン15b及び三角形パターン15cが施されている。このパターン15b、15cの粗さは前述のグラデーションパターン15aの最も荒い部分と同一に設定してある。

【0045】導光板1の光反射面11と対向する側には光出射面12が設けられている。そして、点光源2の各LEDからの光が、光反射面11や導光板1の3つの側面13で反射して、入射光の殆どが最終的に光出射面12から均一な指向性を有する合成光として出射される。

【0046】前述した導光板1の材料としては、透光性材料の中から選択され、通常はアクリルまたはポリカーボネートの樹脂が用いられる。導光板1の形状は平行平板や断面楔形平板で、その厚みは、通常1～5mm程度のものが用いられる。

【0047】また、その他の透光性材料としては、ポリメタアクリル酸メチル、ポリアクリル酸メチル等のアクリル酸エステル又はメタアクリル酸エステルの単独若しくは共重合体、ポリエチレンテレフタレート、ポリブチレンテレフタレート等のポリエステル、ポリカーボネート、ポリスチレン、ポリメチルペンテン等熱可塑性樹脂、或いは紫外線又は電子線で架橋した、多官能のウレタンアクリレート、ポリエステルアクリレート等のアクリレート、不飽和ポリエステル等透明な樹脂、透明な硝子、透明なセラミック等が用いられる。

【0048】点光源2からの各LED光は導光板1の内部に入り、光反射面11に設けられた光反射パターンや3つの側端面13で反射され集束を繰り返し、導光板1の光出射面12から拡散板（図示しない）に出射され、レンズシート（図示しない）によって所望の角度範囲内に均一等方的に拡散されて合成光として出射される。このレンズシートに近接して液晶表示パネルが配置される。

【0049】次に、LED素子からなる点光源2が3灯になった場合の蛍現象対策について説明する。上述の方法では、蛍現象は完全に除去されておらず、例えば拡散シートのヘイズ値あるいはレンズシートの条件によって更に蛍の見えにくい条件を探し出したとしても完全には除去しきれない。

【0050】また、LED素子間欠部の導光板1の反射面11のパターンも効果を出すには限度がある。従って、これ以上の蛍現象対策には然るべき対策が必要である。

【0051】この発明は、上記事情に鑑みなされたものにして、図4及び図5に示すように、LED素子からなる点光源2に垂直方向のプリズム16を導光板1の出射面12全面に施している。すなわち、図4のA部分の拡大図である図5に示すように、光出射面12の全面にプリズム面16が形成されている。この実施形態では、プリズム角度135度、高さは10μm、プリズムピッチは50μmに設定した。このように設定したプリズムを施すことで、LED素子からなる点光源2から点在する光を横方向に広げることができ、輝度ムラ等の問題解決を図ることができる。そして、前述の光が到達しない箇所にも光が行き渡り、導光板1の反射面11のパターン効果と相乗した形で蛍現象が激減されるという特徴を併せ持つ。

【0052】前述のような考え方は、図示はしないが、例えば、4インチバックライトにも適用可能である。4インチバックライトは現状では、LED素子からなる点光源を8～12個使用しているが、前述のようなLED個数削減に際してもこの発明が適用できることは言うまでもない。

【0053】次に、この発明の第2の実施形態につき説明する。この第2の実施形態の全体的な構成は、第1の実施形態と同様であるが、図6及び図7に示すように、出射面12のプリズムを全面には施さず、点光源2近傍部分のみ集中してプリズム16aを施すものである。プリズムの形態は点光源2側から遠ざかるに従って徐々に溝が浅くなるように構成されている。すなわち、溝が途中で終わっているような形状の場合の溝終点の筋などの光学的影響を回避するものである。

【0054】この形状に構成することで、点光源2の近傍の最も蛍現象が生じるところでは溝が深く、光源から離れるに従って蛍現象も減少するに伴い溝が必要ではなくなるという特性を利用したものである。

【0055】尚、全面プリズムについては、図8、図9、図10に示すように、バックライト全体の輝度及び輝度ムラに大きく影響するものではないことが分かる。図8は導光板出射面全面プリズムの有無による光学特性を9ポイント測定で測定した結果を示し、図9は導光板出射面全面プリズムによる輝度分布を相対値で表したもの、図10は導光板出射面にプリズムを設けないものによる輝度分布を相対値で表したものである。この実施形態における導光板は散乱導光板を用いたため、導光板そのものの光の散乱効果が大きく、出射面プリズムによる拡散効果のウェイトが低いと考えられる。クリア導光板

であれば効果はきわめて大きい。

【0056】

【発明の効果】以上説明したように、この発明は、バックライト等を構成する面光源装置において、点光源（ＬＥＤ素子）の個数を減らした場合の導光板出射面において、点光源に垂直方向のプリズムを施し、ＬＥＤから点在する光を横方向に広げることで、点光源付近に点在した蛍現象が回避でき、輝度ムラ等の問題解決を図ることができる。

【図面の簡単な説明】

【図１】従来の面光源装置の導光板に反射シートを装着した状態を示す斜視図である。

【図２】従来の面光源装置の概略構成を示す断面図である。

【図３】この発明に関わるＬＥＤ素子の個数削減及び３灯間隔の決定推移を示す説明図である。

【図４】この発明の第１の実施形態にかかる面光源装置の概略構成を示す斜視図である。

【図５】この発明の要部である出射面の拡大斜視図である。

【図６】この発明の第１の実施形態にかかる面光源装置の概略構成を示す斜視図である。

【図７】この発明の要部である出射面の拡大斜視図である。

【図８】導光板出射面全面プリズムの有無による光学特性を９ポイント測定で測定した結果を示す図である。

【図９】導光板出射面全面プリズムによる輝度分布を相対値で表した図である。

【図１０】導光板出射面にプリズムを設けないものによる輝度分布を相対値で表した図である。

【符号の説明】

１　導光板

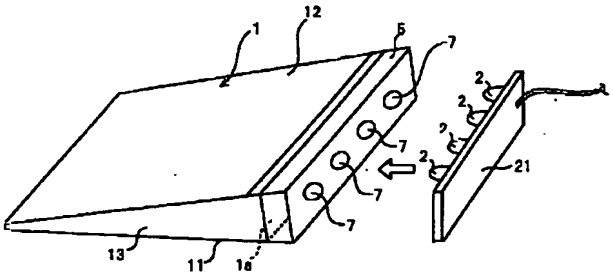
２　点光源（ＬＥＤ素子）

１１　光反射面

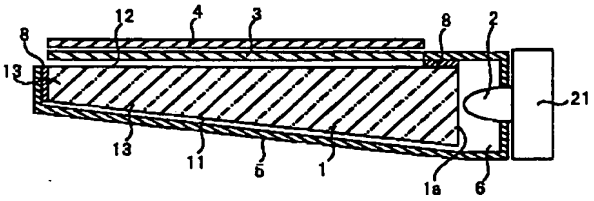
１２　光出射面

１６　プリズム面

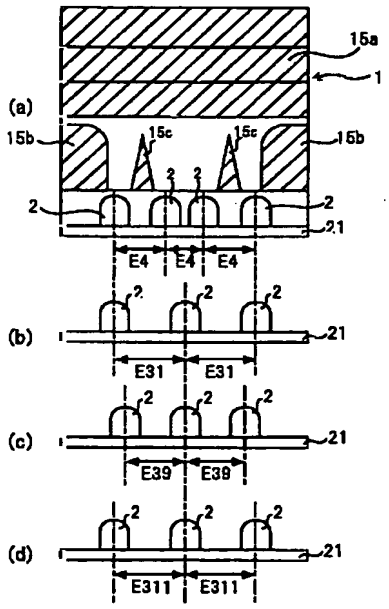
【図１】



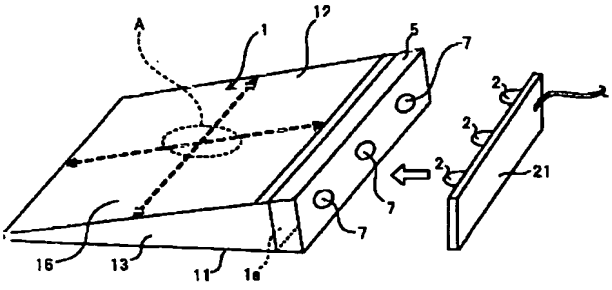
【図２】



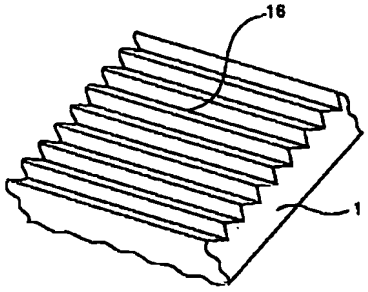
【図３】



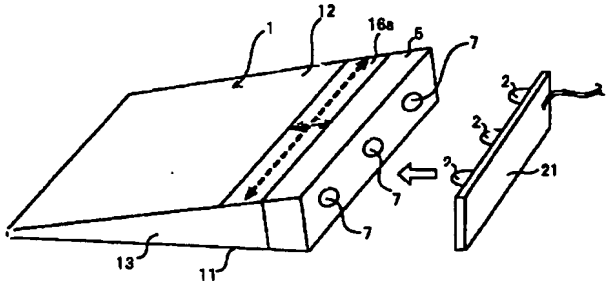
【図４】



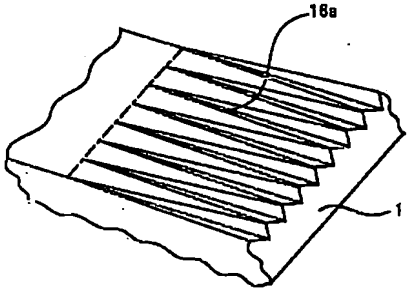
【図5】



【図6】



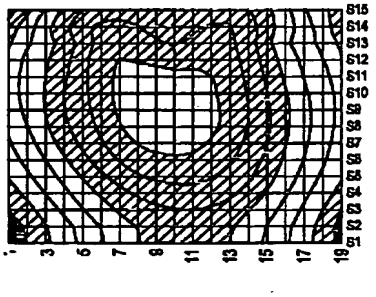
【図7】



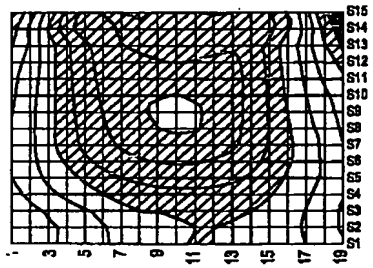
【図8】

測定位置	プリズムなし	本発明プリズム
中央	2321	2386
ヒ	2025	2130
右上	1845	1787
右	2011	2011
右下	2018	1989
F	2155	2198
左下	1884	1899
左	1964	1989
左上	1917	1859
平均	2016	2028
Max	2321	2386
Min	1845	1787
輝度ムラ	78%	75%

【図9】



【図10】



フロントページの続き

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